

ANNUAL REPORT FOR 2000



Pembroke Creek Mitigation Site
Chowan County
Project No. 8.T010602
TIP No. R-2512



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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Pembroke Mitigation Site. Site construction began in 1998 and was finished in 1999. The year 2000 represents the second year for hydrology and vegetation monitoring.

The Pembroke Creek Mitigation Site in Chowan County is a bottomland forest site divided into two areas. The site was constructed to mitigate for the impacts from the improvements to US 17 in Bertie and Chowan Counties (R-2512).

One major change in the hydrologic monitoring process is the use of data from an Infinity rain gauge that was installed on the site in May. The daily rainfall on the gauge data graphs from March 17 through June 1 was recorded at the Edenton rain gauge, maintained by the NC State Climate Office. Data from June 2 through December 1, 2000 was provided from the Infinity rain gauge located on the site.

Hydrologic monitoring indicated that both sites were inundated or saturated (within 12" of the surface) by surface or ground water for at least 12.5% of the growing season. Hydrologic success for this site is based on the mean depth to groundwater of the gauges in the restoration area within 20% of the mean depth to groundwater of the gauges in the respective reference area. Three of the four gauges were within 20% of reference gauges. One gauge (PC-2) did not meet this criteria. The water table was, however, within 12 inches of surface for more than 12.5% of the growing season, which meets the standard hydrologic criteria. Therefore, monitoring from the 2000 growing season indicates hydrologic success. Vegetation data met all established success criteria.

Based on the monitoring results from the 2000 growing season, NCDOT will continue hydrologic monitoring until success criteria are met or enough information can be collected on the site that appropriate changes can be made to help in achieving success.

1.0 INTRODUCTION

1.1 Project Description

The site is located adjacent to US 17 in Chowan County (Figure 1). Designed as a bottomland forest, it is to mitigate for the effects of the improvements to US 17 in Bertie and Chowan Counties (R-2512).

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic, and vegetative monitoring must be conducted for a minimum of three years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetation monitoring during the 2000 growing season at the Pembroke Creek Mitigation Site. Included in this report are analyses of both hydrologic and vegetative monitoring results as gauge as local climate conditions throughout the growing season. The vegetation planted represents Phase I and Phase 2 of the project's construction. Hydrologic monitoring of the site began in March of 1999.

1.3 Project History

| | |
|----------------------|---|
| November 1997 | Site Constructed (Phase I) |
| January 1998 | Site Planted (Phase I) |
| October 1998 | Vegetation Monitoring (1 yr.) (Phase I) |
| November 1998 | Site Constructed (Phase II) |
| February 1999 | Monitoring Gauges Installed |
| March-November 1999 | Hydrologic Monitoring (1 yr.) |
| March 1999 | Site Planted (Phase II) |
| October 1999 | Vegetation Monitoring (1 yr.) |
| March-November 2000 | Hydrologic Monitoring (2 yr.) |
| August, October 2000 | Vegetation Monitoring (2 yr.) |

FIGURE 1. SITE LOCATION MAP



2.0 Hydrology

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, a site meets hydrologic criteria if it is inundated or saturated (within 12" of the surface) by surface or ground water for at least 12.5% of the growing season. However, discussions between NCDOT and natural resource agencies have determined that, due to the unique character of this site, the normal guidelines for hydrologic success may not apply. Groundwater levels may vary significantly on a daily basis due to a sandy substrate that is in close proximity to a tidally-influenced body of water

The growing season in Chowan County begins March 13 and ends December 1. These dates correspond to a 50% probability that air temperatures will drop to 28° or lower after March 13 and before December 1.¹ Thus the growing season is 262 days; optimum wetland hydrology requires 12.5% of this growing season, or 32 days. The site must also experience average climatic conditions in order for the hydrologic data to be considered valid.

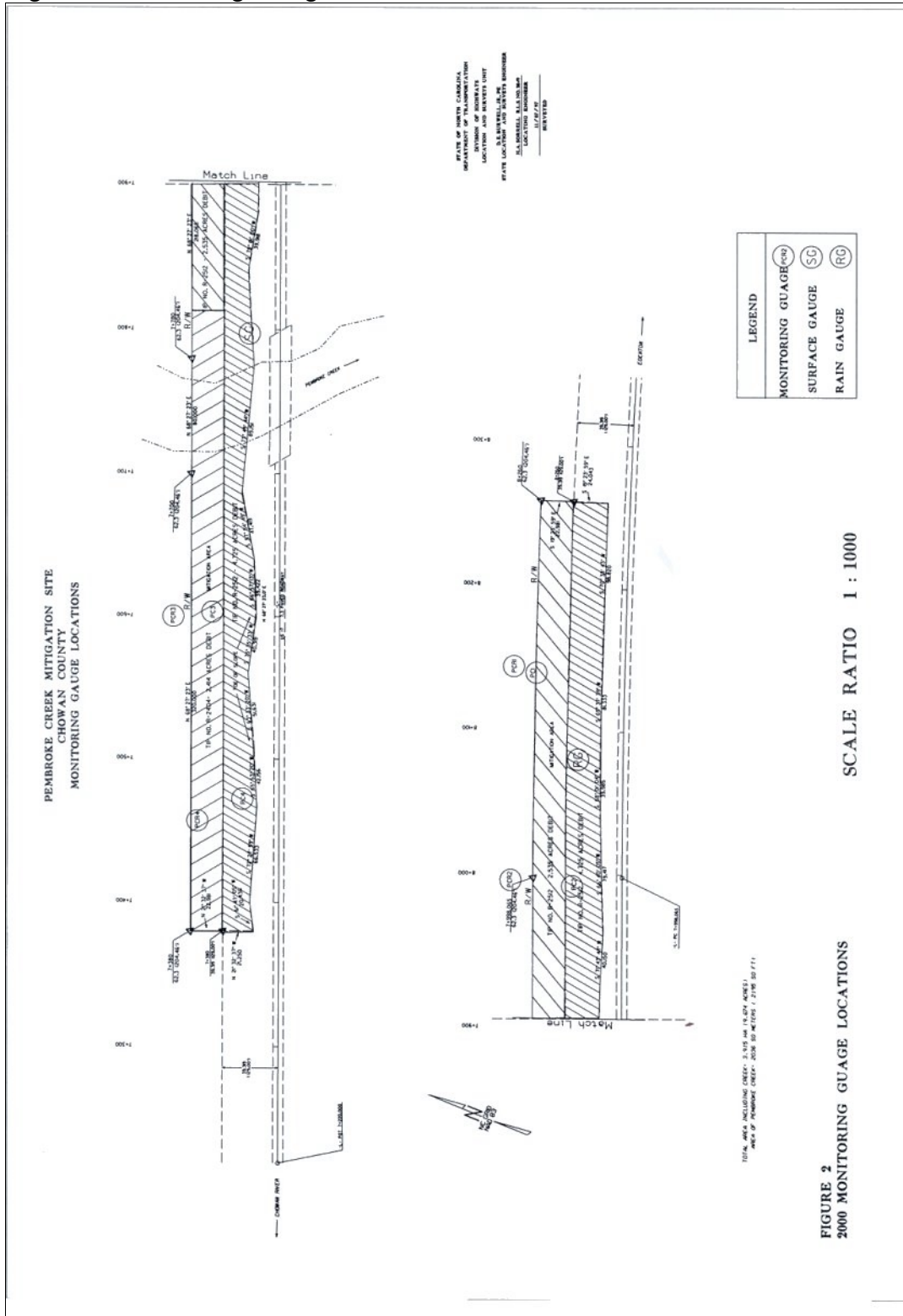
2.2 Hydrologic Description

Eight monitoring gauges, one rain gauge, and one surface water gauge were installed on site in February 1999 and data was recorded starting in March 1999 (Figure 2). The automatic monitoring gauges and rain gauges record the depth to groundwater and rainfall, respectively. Data was collected on a daily basis throughout the growing season.

Appendix A contains a plot of the water depth for each monitoring gauge and surface water gauge in 2000. Precipitation events are included on each graph as bars.

¹ Soil Conservation Service. Soil Survey of Chowan and Perquimans Counties, North Carolina, p.76.

Figure 2. Monitoring Gauge Locations



2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days in which the groundwater was within twelve inches of the surface was determined for each gauge. The number of days was then converted into a percentage of the 262-day growing season. Table 1 gives the results for the 2000 growing season (March 13-December 1).

TABLE 1. HYDROLOGIC MONITORING RESULTS

| Monitoring Gauge | < 5% | 5% - 8% | 8% - 12.5% | > 12.5% | Actual % | Dates of Success |
|-------------------------|----------------|----------------|-------------------|-------------------|-----------------|-------------------------|
| PC-1 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PC-2 | | | | ✓ | 21% | Mar 13- May 7 |
| PC-3 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PC-4 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PCR-1 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PCR-2 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PCR-3 | | | | ✓ | 100% | Mar 13- Dec 1 |
| PCR-4 | | | | ✓ | 100% | Mar 13- Dec 1 |

Specific monitoring gauge problems: PCRG-1 stopped recording on 2/19/00, battery was replaced and set to record on 3/21/00. PC-1 stopped recording on 9/14/00, battery was replaced and set to record on 10/11/00. Figure 3 is a graphical representation of the hydrologic monitoring results.

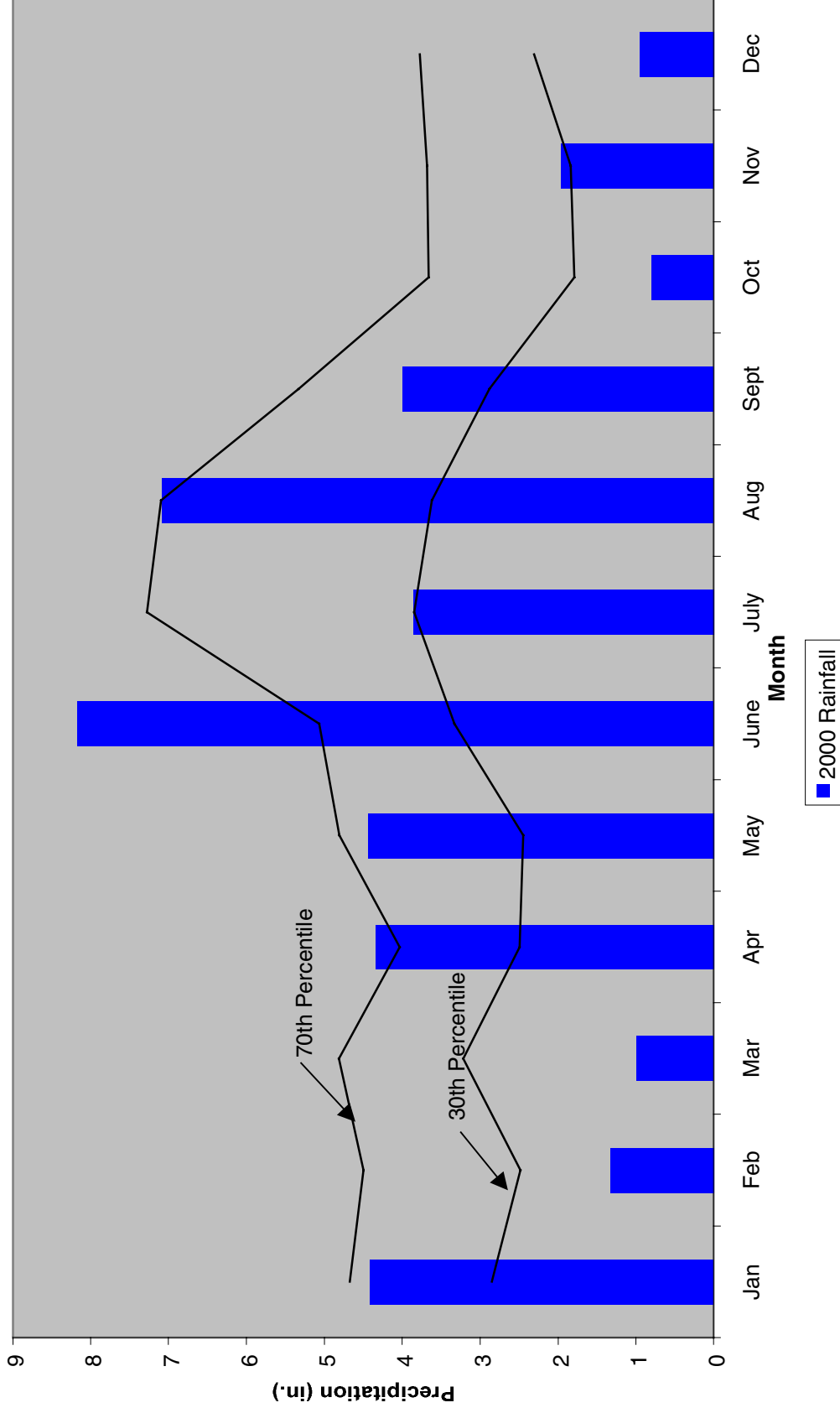
9



2.3.2 Climatic Data

Figure 4 is a comparison of 2000 monthly rainfall to historical precipitation for the Edenton area. Rainfall data recorded at the Edenton weather station and onsite during the growing season was compared to the historical 30-70 percentile trends for the area. It is assumed that if the 2000 rainfall totals, represented by bars, fall between the average precipitation values for each month, then the local climate was experiencing average conditions for that particular region.

Pembroke Creek 30-70 Percentile Graph
Edenton, NC



3.0 VEGETATION: PEMBROKE MITIGATION SITE (YEAR 2 OF 3)

3.1 Success Criteria

Success Criteria states that there will be a minimum density of 320 trees per acre of approved target species surviving for at least three consecutive years.

3.2 Description of Species

The following tree species were planted in the Phase I Restoration Area:

Zone 1: (0.854 HA)

- 70% *Chamaecyparis thyoides*, Atlantic white cedar
- 30% *Taxodium distichum*, bald cypress

Zone 2: (0.327 HA)

- 40% *Nyssa aquatica*, tupelo gum
- 30% *Fraxinum pennsylvanica*, green ash
- 30% *Quercus lyrata*, overcup oak

Zone 3: (0.468 HA)

- 35% *Taxodium distichum*, bald cypress
- 35% *Nyssa aquatica*, tupelo gum
- 30% *Nyssa sylvatica* var. *biflora*, swamp tupelo.

Phase II was planted in the winter of 1998-99. The following tree species were planted in the Phase II Restoration Area:

Zone 1: (0.88 HA)

- 70% *Chamaecyparis thyoides*, Atlantic white edar
- 30% *Taxodium distichum*, bald cypress

Zone 2: (0.35 HA)

- 40% *Nyssa aquatica*, tupelo gum
- 30% *Fraxinum pennsylvanica*, green ash
- 30% *Quercus lyrata*, overcup oak

Zone 3: (0.8 HA)

- 35% *Taxodium distichum*, bald cypress
- 35% *Nyssa aquatica*, tupelo gum
- 30% *Quercus lyrata*, overcup oak

3.3 Results of Vegetation Monitoring

| | Plot # | Bald Cypress | Atlantic White Cedar | Green Ash | Overcup Oak | Tupelo Gum | Swamp Tupelo | Total | Total (at planting) | Density (Tree/Acre) |
|------------------------|--------|--------------|----------------------|-----------|-------------|------------|--------------|-------|---------------------|---------------------|
| ZONE 1 | 1 | 23 | 2 | | | | | 25 | 28 | 607 |
| | 6 | 13 | | | | | | 13 | 33 | 268 |
| ZONE 1 AVERAGE DENSITY | | | | | | | | | | 438 |
| ZONE 2 | 2 | | | 16 | 4 | 6 | | 26 | 30 | 589 |
| | 5 | 1 | | 13 | 11 | 9 | | 34 | 37 | 625 |
| ZONE 2 AVERAGE DENSITY | | | | | | | | | | 607 |
| ZONE 3 | 3 | 10 | | | | 6 | 3 | 19 | 30 | 431 |
| | 4 | 21 | | | 7 | 2 | 9 | 39 | 43 | 617 |
| ZONE 3 AVERAGE DENSITY | | | | | | | | | | 524 |
| TOTAL AVERAGE DENSITY | | | | | | | | | | 523 |

To determine tree density, 50' x 50' plots were installed immediately following planting. The actual number of planted trees which occur within the plot was counted. This number was equated to the number within each plot, which represents 680 trees per acre (average). The survival monitoring number was compared to the planted number to obtain survival percentage. This percentage was applied to the 680 trees per acre to obtain an estimated tree per acre for the site. (Density = monitoring count / planted trees x 680)

Site Notes: Other species noted included: juncus, duck potato, woolgrass, cattail, few red maple, smartweed, phragmites, black willow pickeral, briars, fennel, sycamore, river birch, wild strawberry, foxtail, pokeberry, various grasses and sedges, cardinal flower, carex, goldenrod, green arrow arrum, and aster.

3.4 Conclusions

The vegetation monitoring reveals an average density of 438 trees per acre for zone 1, 607 trees per acre for zone 2, 524 for zone 3 and 523 trees per acre for the site's average. All are above the minimum of 320 trees per acre required by the success criteria.

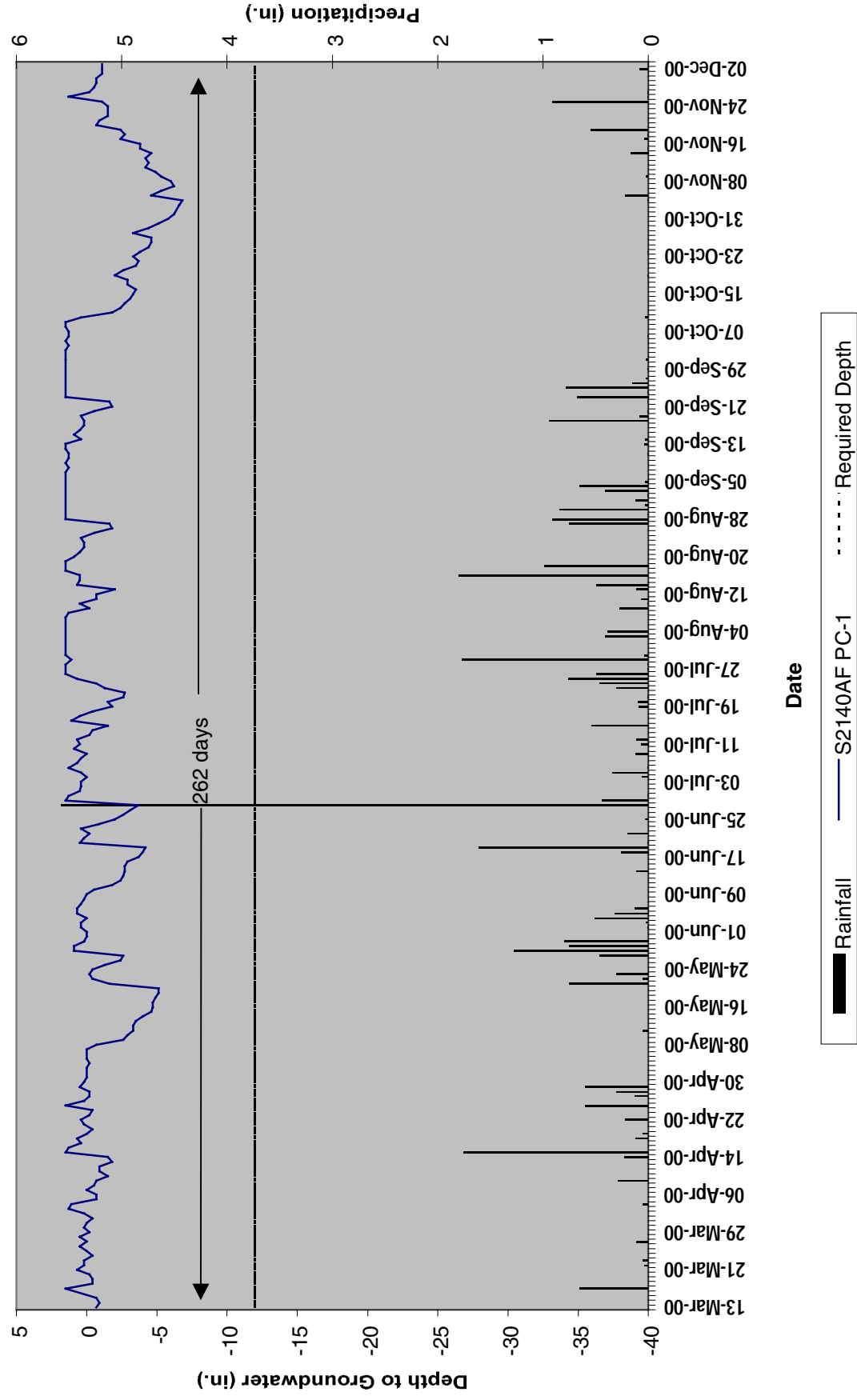
4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

Hydrologic success for this site is based on the mean depth to groundwater of the gauges in the restoration area being less to not greater to 20% of the mean depth to groundwater of the gauges in the respective reference area. One gauge, PC-2 did not fall within 20% of the mean depth to watertable of its reference gauge (PCR-2). The water table, however, was within 12 inches of surface for more than 12.5% of the growing season, which meets the standard hydrologic criteria. Therefore, monitoring from the 2000 growing season indicates success in both hydrology and vegetation survival.

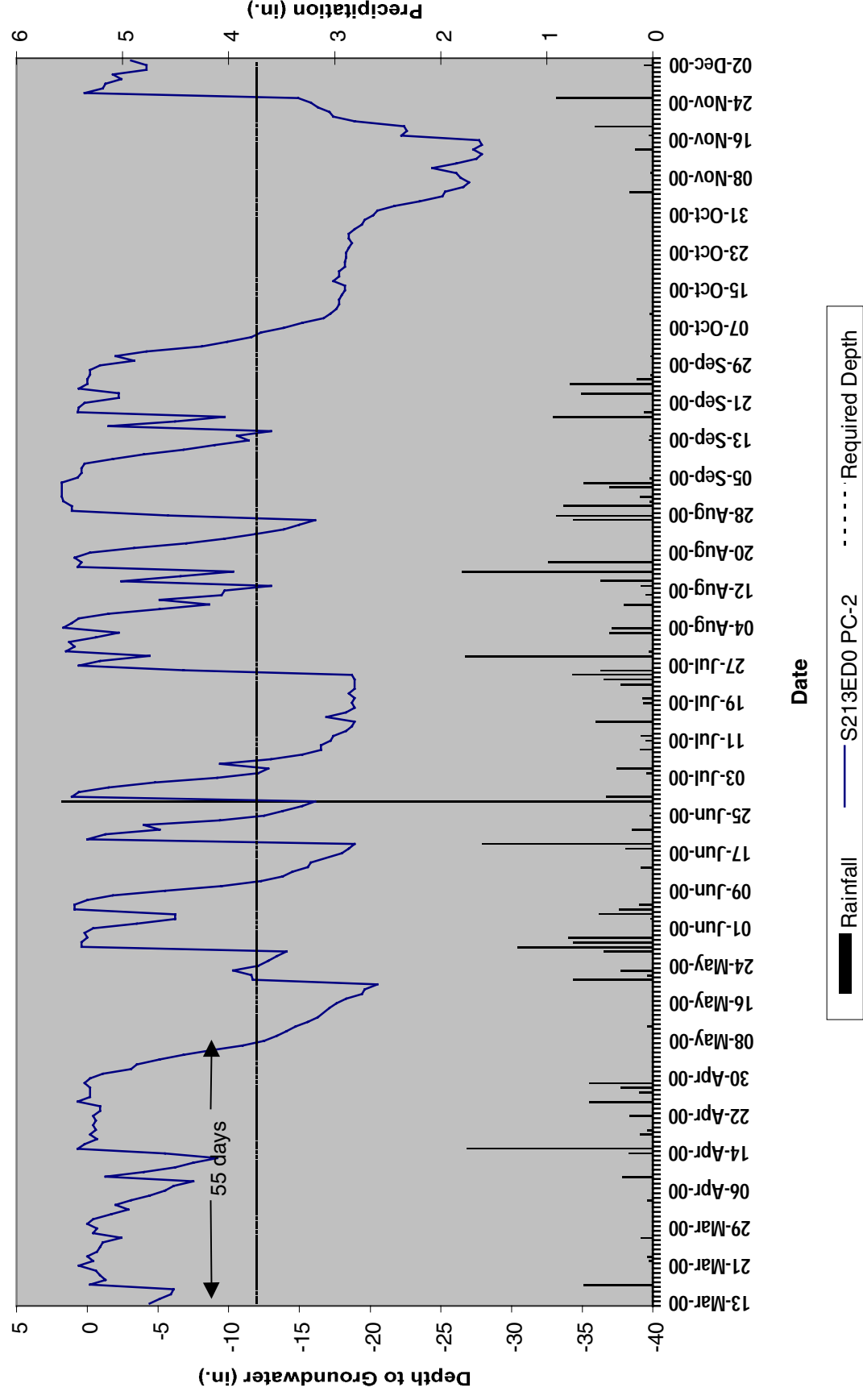
NCDOT intends to continue both hydrologic and vegetation data in 2001.

APPENDIX A. DEPTH TO GROUNDWATER PLOTS

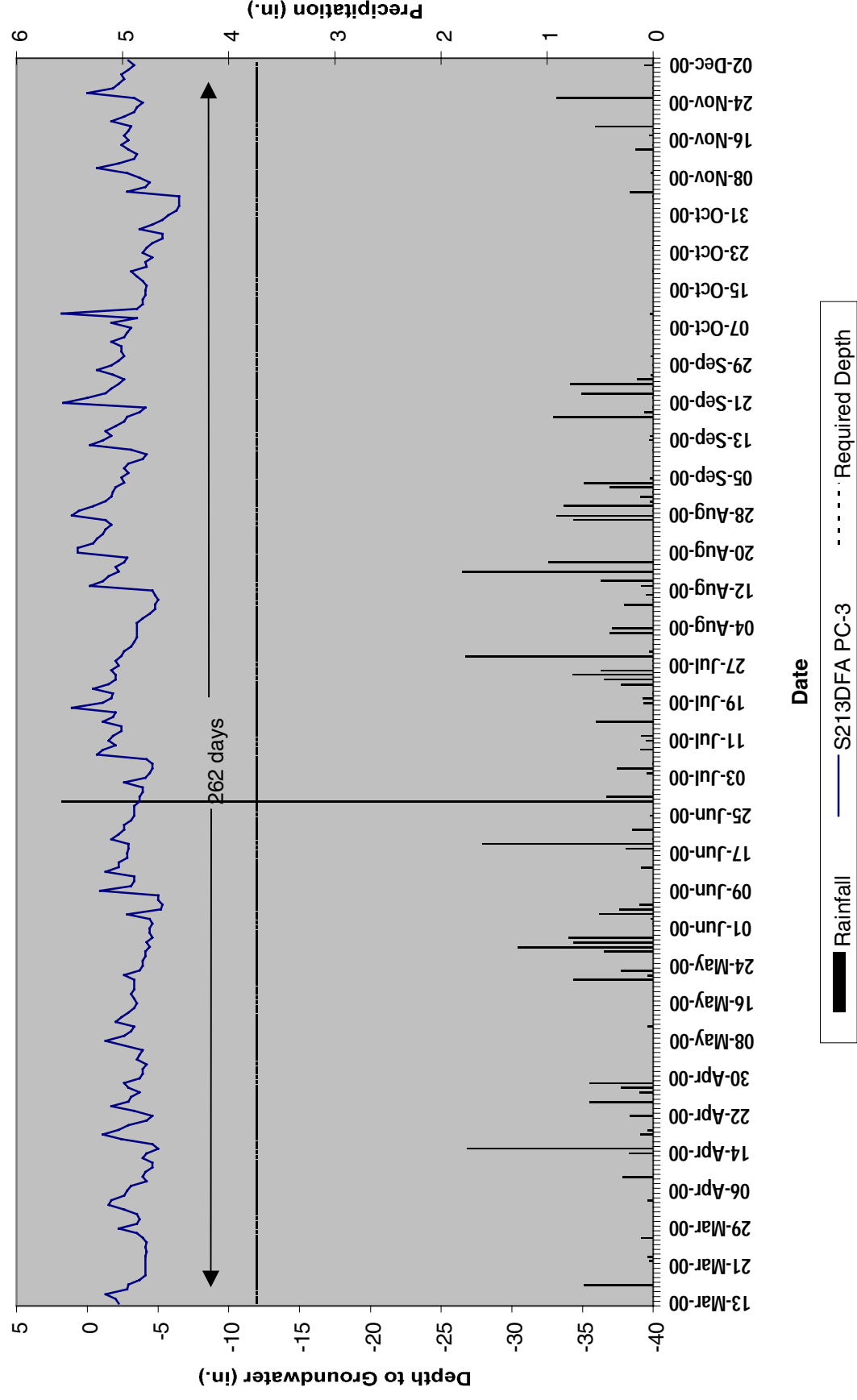
Pembroke Creek PC-1



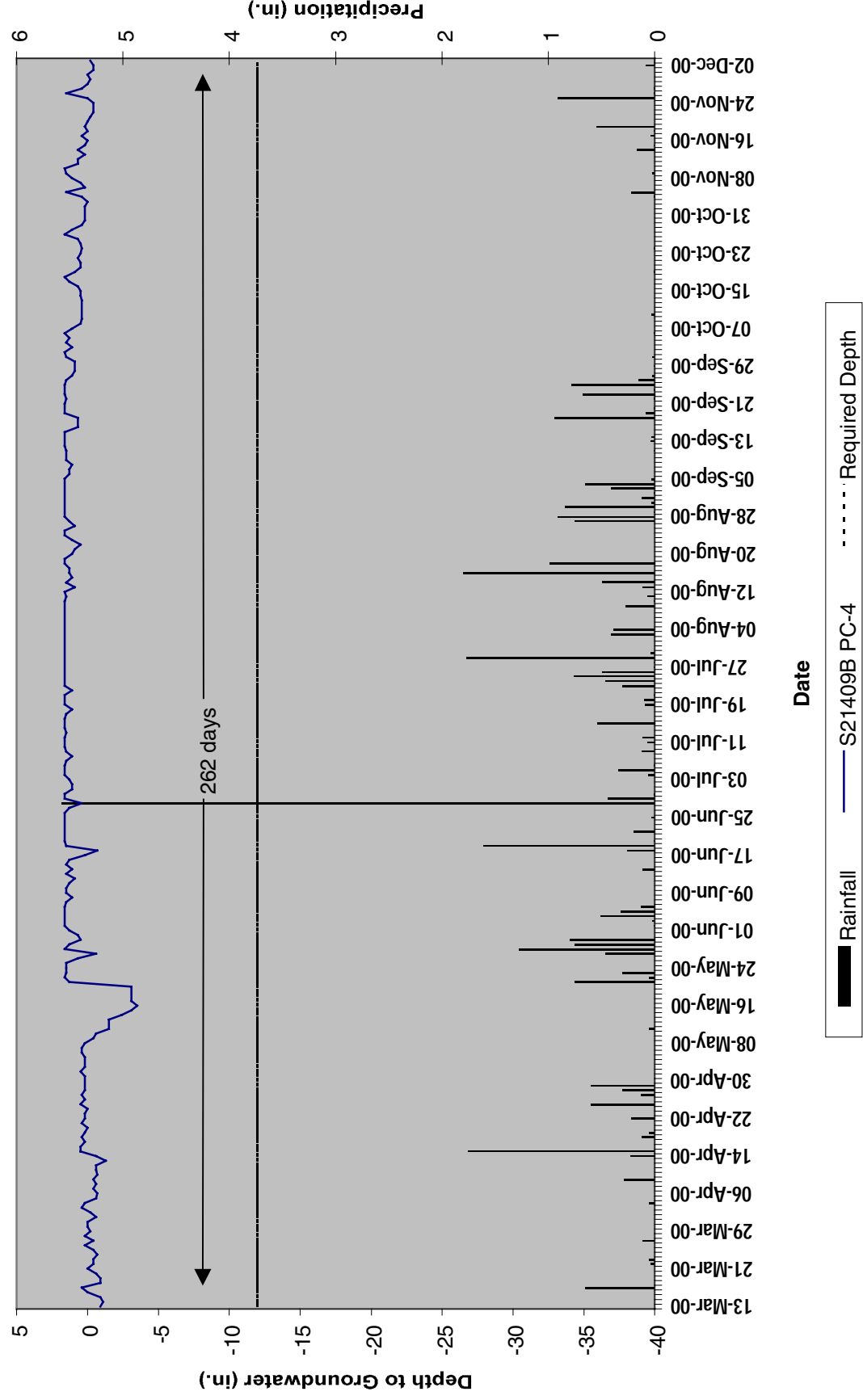
Pembroke Creek PC-2



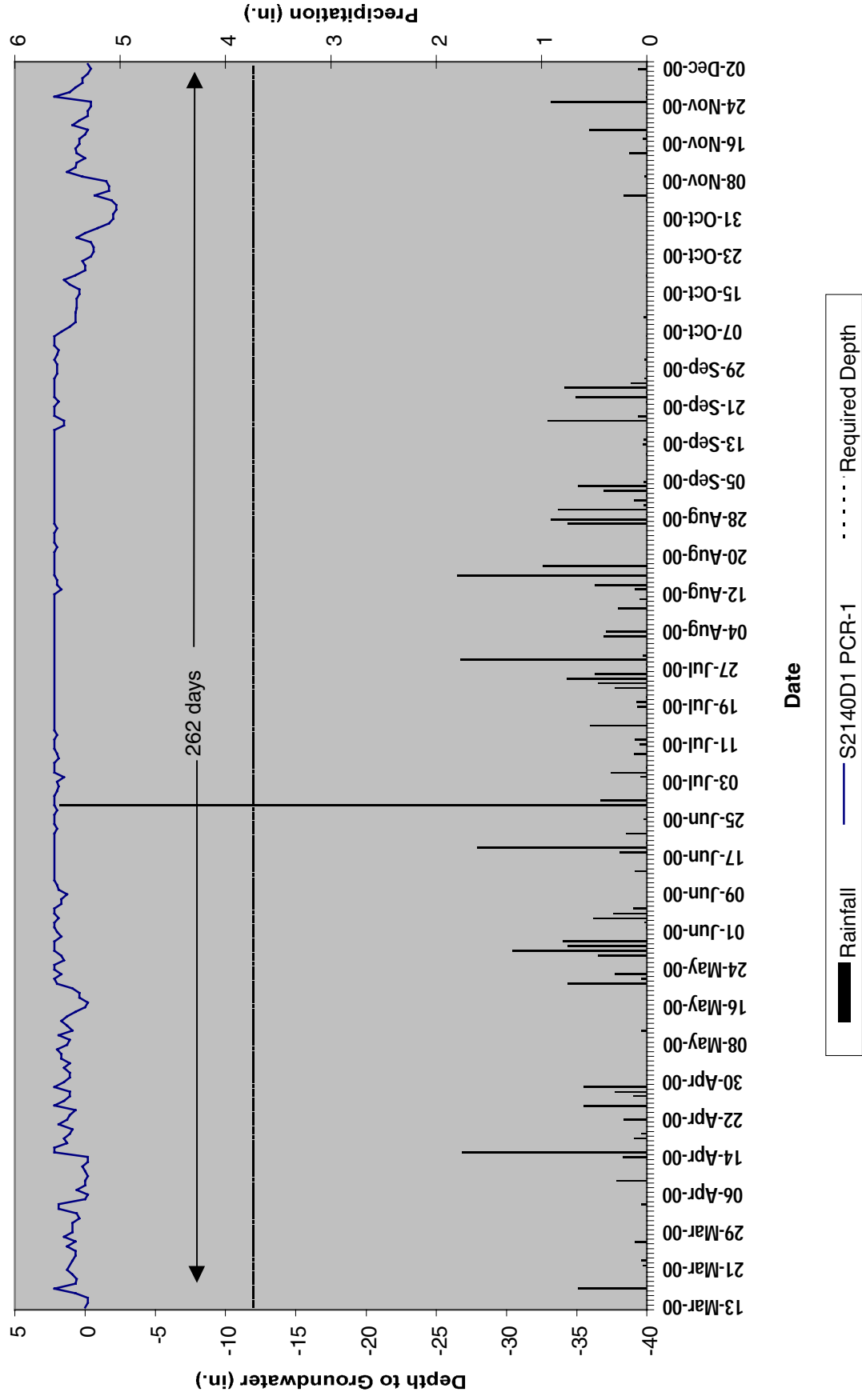
Pembroke Creek PC-3



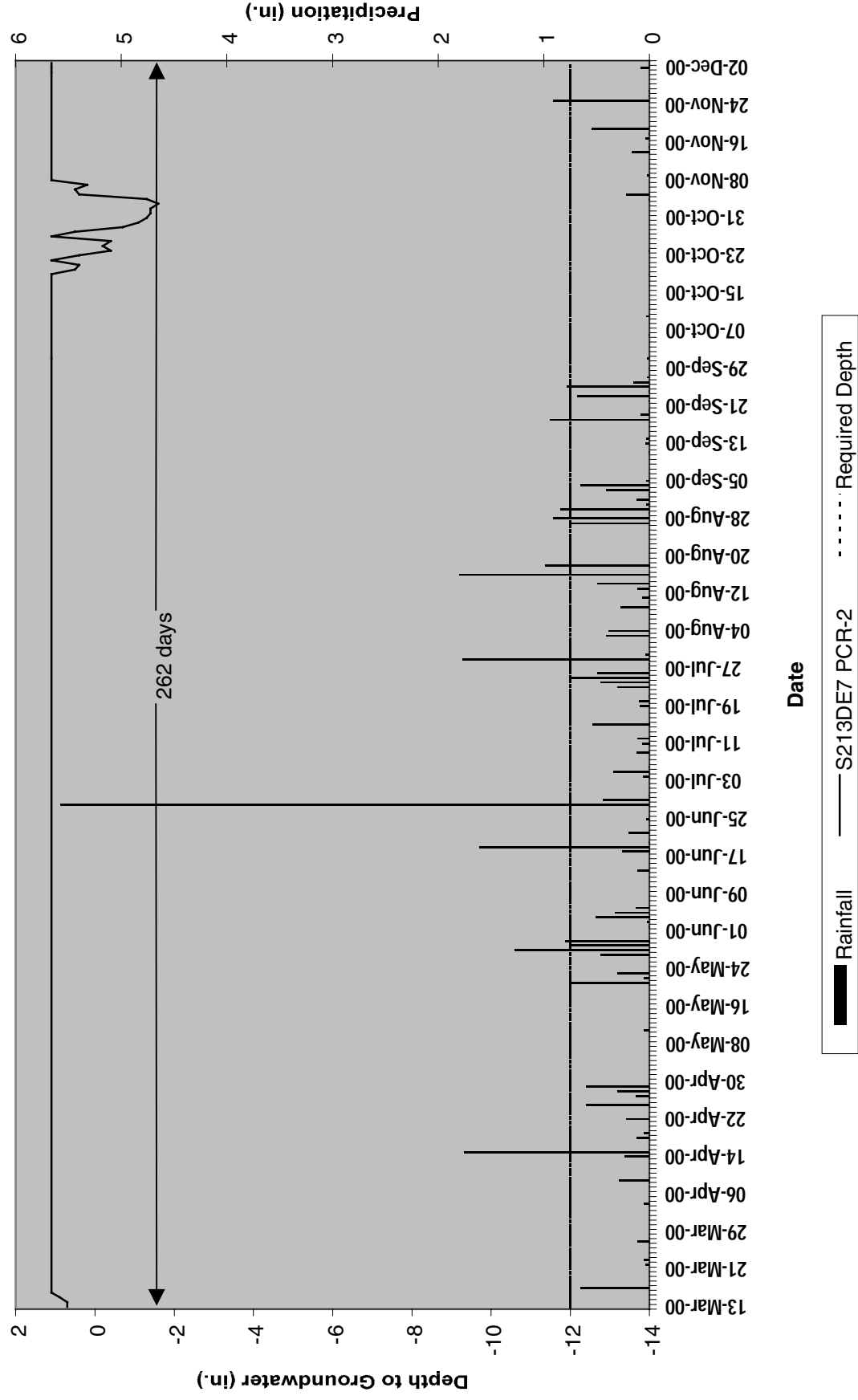
Pembroke Creek PC-4



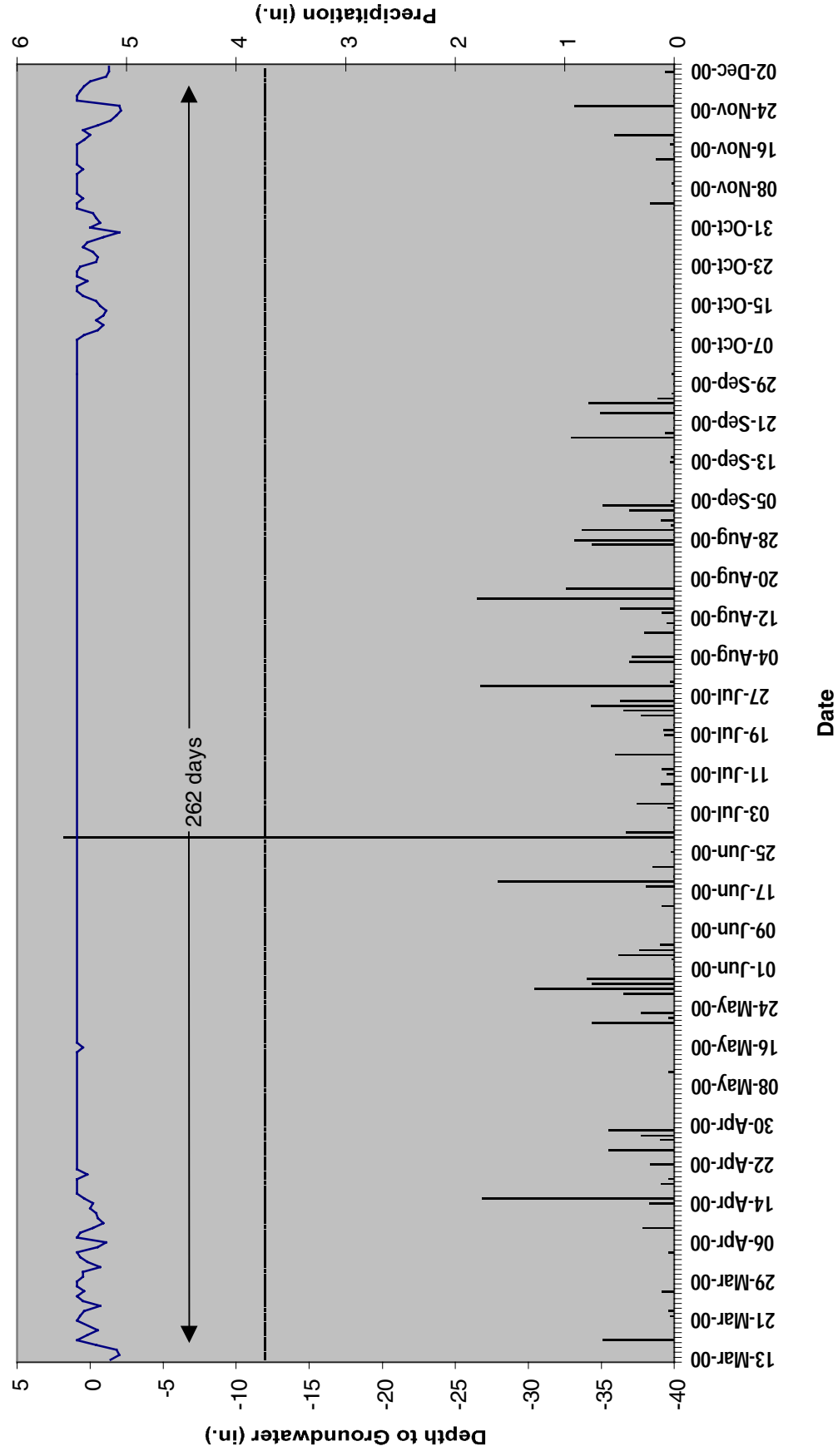
Pembroke Creek PCR-1



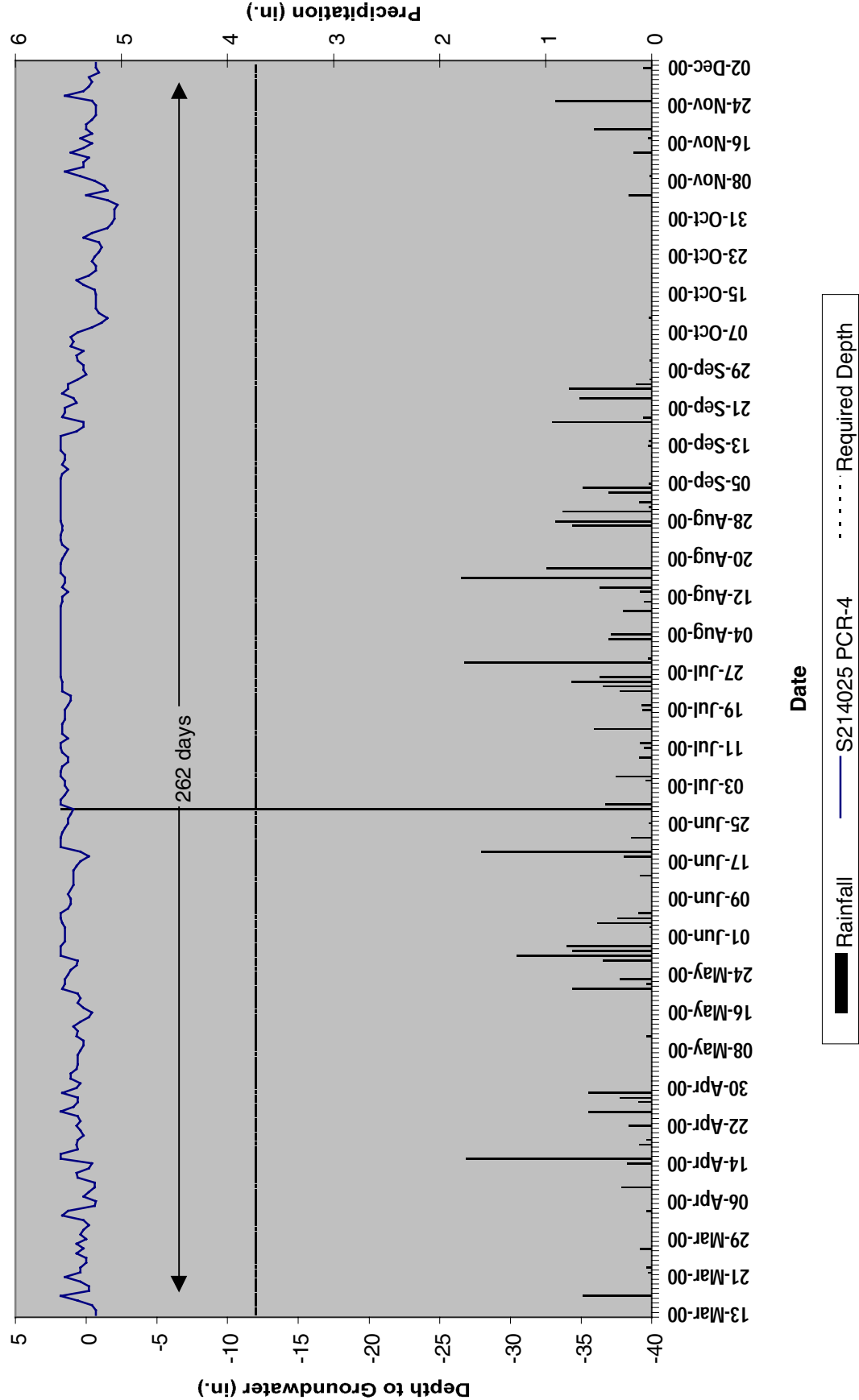
Pembroke Creek PCR-2



Pembroke Creek PCR-3



Pembroke Creek PCR-4



APPENDIX B. SITE PHOTOS



Photo 1




Photo 2



Photo 3

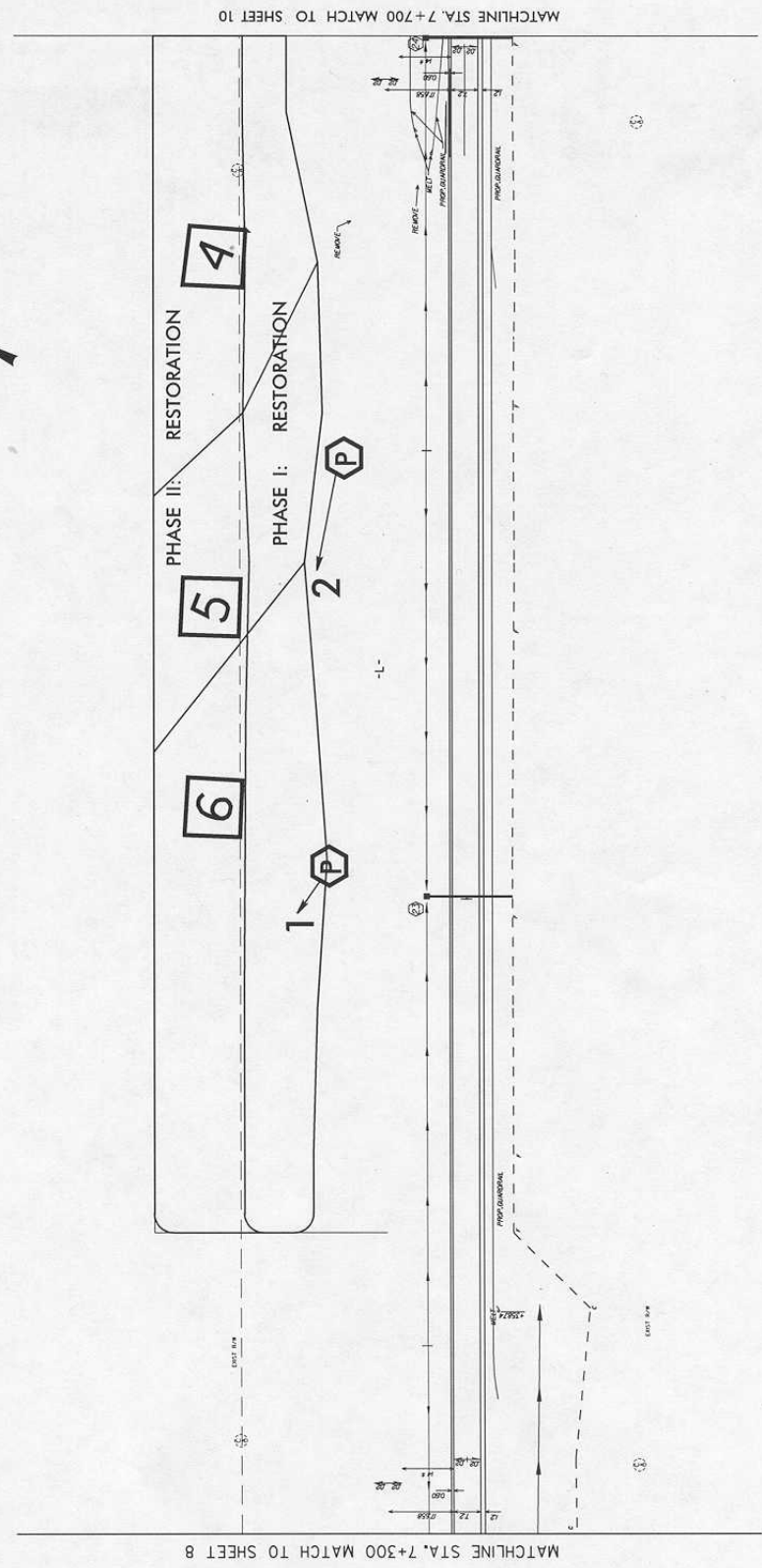


Photo 4



| | | |
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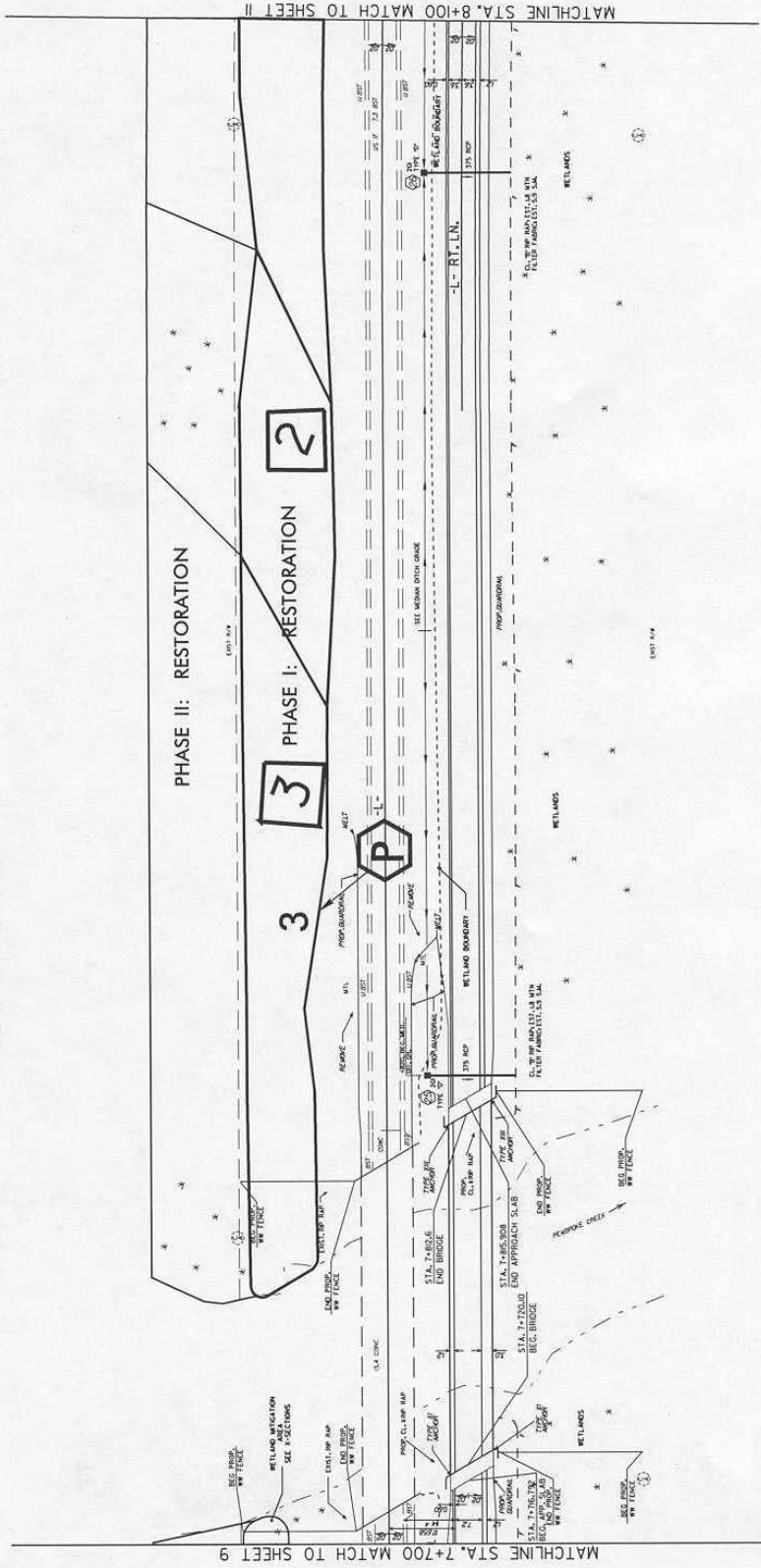
| | |
|-------------|----|
| 5 | 10 |
| CONST. REV. | |
| B/W REV. | |

PEMBROKE CREEK
Wetland Mitigation Site
Photo and Plot Locations



PEMBROKE CREEK Wetland Mitigation Site Photo and Plot Locations

| | | |
|---|-----------------------|------------------------------|
|  | PROJECT REFERENCE NO. | SHEET NO. |
| | WETLAND MITIGATION | WETLANDS |
|  | | 5 0 10 DIST. (FEET) |
| CONSULT. REV. BY/REV. | | |



| | | | |
|---|---|---|--|
|  |  | PROJECT REFERENCE NO. <u>102020</u> HIGHWAY DESIGN ENGINEER | SHEET NO. <u>REV-1</u> INTERMEDIATE ENGINEER |
| | | | |
| CONST. REV. | | | |
| R/W REV. | | | |

